

CANDIDATE
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BIOLOGY

9700/52

Paper 5 Planning, Analysis and Evaluation

May/June 2015

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use a soft pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

This document consists of **8** printed pages.

- 1 Many fungi are decomposer organisms which carry out extracellular digestion. To secrete a number of enzymes.

A group of students made a solution of enzyme extract from a fungus. The extract contained enzyme amylase. They wanted to find out the concentration of amylase in the extract.

They were provided with:

- 0.5 g dm^{-3} stock solution of amylase
- starch agar plates with wells into which enzyme solutions can be placed. Starch agar plates are Petri dishes containing agar mixed with starch.

Fig. 1.1 shows how the students used the plates to find the concentration of amylase.

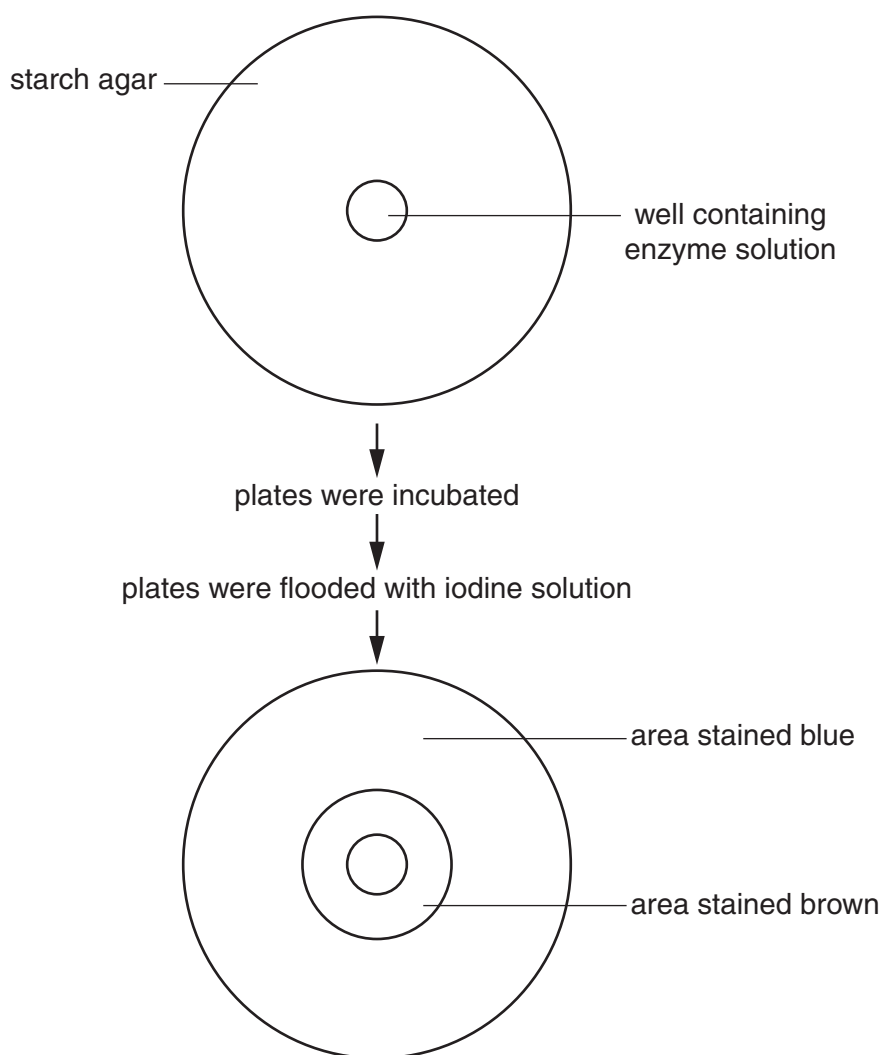


Fig. 1.1

The students thought that the area stained brown was proportional to the amylase concentration.

- (a) Identify the independent and dependent variables in this investigation.

independent variable

dependent variable [2]

- [8]

- (c) There are different types of amylase enzyme. They hydrolyse starch in different ways. Two of these enzymes are:

- β -amylase hydrolyses every second α -1,4 glycosidic bond in starch molecules
- γ -amylase hydrolyses all α -1,6 glycosidic bonds and all α -1,4 glycosidic bonds in starch molecules.

In a second investigation, the students were provided with two beakers, **A** and **B**. One contained β -amylase and the other contained γ -amylase. They used these solutions to hydrolyse 25 cm³ samples of 0.5 g dm⁻³ starch solution.

Suggest **and** explain how the students could identify which beaker contained β -amylase and which contained γ -amylase.

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..... [2]

- (d) Humans produce the enzyme α -amylase in their salivary glands. There may be many copies of the gene coding for α -amylase on chromosome 1. The concentration of the α -amylase in the saliva is positively correlated with the number of copies of this gene.

In a third investigation, the students obtained saliva from six people, **A** to **F**. Equal volumes of saliva were added to wells in agar plates similar to those shown in Fig. 1.1.

The plates were incubated for the same length of time and the area of the brown zone for each sample of saliva was calculated.

Table 1.1 shows results of this investigation.

Table 1.1

enzyme extract	area of brown zone/mm ²					
	plate 1	plate 2	plate 3	plate 4	plate 5	plate 6
A	3632	3848	3632	3632	3632	3848
B	2827	2827	2642	2463	1963	2827
C	2124	1963	1963	2124	1963	2124
D	1385	1257	1809	1257	1257	1385
E	656	707	707	656	707	656
F	298	298	314	314	298	298

- (i) Identify **two** results in Table 1.1 that may be anomalous. Show your answer by writing down the two values.

- (ii) State how the students should deal with these anomalies.

.....[1]

- (iii) The students decided to calculate the standard deviations of their results using the formula:

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$$

Key to Symbols

s = standard deviation x = a result \bar{x} = mean Σ = sum of n = sample size

Use Table 1.2 and the formula above to calculate the standard deviation for the results for person **F**.

Table 1.2

plate	x	$x - \bar{x}$	$(x - \bar{x})^2$
1	298		
2	298		
3	314		
4	314		
5	298		
6	298		
Σ			
\bar{x}			

answer [2]

- (iv) Suggest an explanation for the results shown in Table 1.1.

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..... [3]

[Total: 20]

- Surface electrodes are placed on the skin over nerves at various locations. They produce a mild electrical charge, which stimulates the nerve.

The resulting electrical activity in the nerve is measured by a recording electrode. The distance between the electrodes and the time it takes for electrical impulses to travel between them are used to determine the nerve conduction velocity.

The diagram illustrates the experimental setup for monitoring the ulnar nerve. It shows a lateral view of a hand and forearm. A line indicates the 'position of ulnar nerve' running along the inner side of the forearm. Two 'surface electrode' pads are placed on the skin, one proximal and one distal to the nerve's path. A 'monitoring device' is connected to these electrodes via wires.

Fig. 2.1

An investigation to measure the NCV in the ulnar nerve in females of different ages was carried out on 394 individuals.

- [3

Table 2.1 shows the results of this investigation.

Table 2.1

age category / years	mean conduction velocity $\pm S_M$	confidence limits	
		lower limit	upper limit
30–39	54.3 \pm 1.200	51.90	56.70
40–49	54.7 \pm 0.645	53.41	55.99
50–59	52.4 \pm 0.600	51.20	53.60
60–69	52.2 \pm 0.675		
70–79	49.0 \pm 1.075	46.85	51.15

S_M = standard error

- (b) The confidence limit = mean \pm 2 S_M .

Use this formula to calculate the missing confidence limits. Use the space below for any working and enter your answers in Table 2.1.

[1]

One conclusion from these data is that mean conduction velocity in the ulnar nerve varies significantly with age.

- (c) (i) Identify **two** age categories which appear to support this conclusion and give a reason for your choice.

age categories and

reason

.....

..... [2]

- (ii) State which statistical test could have been used to confirm this conclusion. Give a reason for your choice.

test

reason [2]

- (iii) State a null hypothesis for this test.

..... [1]

- (d) State **one** reason why the results of the investigation were considered to be reliable.

..... [1]

[Total: 10]

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